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PHOTOGRAPHIC INTERPRETATION REPORT

PHOTOGRAPHIC STUDY OF HEN ROOST

ANTIMISSILE TEST CENTER

SARY SHAGAN, USSR

NPIC/R-1004/61
November 1961

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

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PREFACE

This report presents a detailed photographic study of HEN ROOST (500-foot antenna) at the Antimissile Test Center, Sary Shagan, USSR, in response to CIA requirements OSI/R-1/61 and OSI/R-33/61 and NSA requirement GENS-6A/R6-61. Although the exact antenna configuration cannot be defined, the report objectively describes those components which can be positively identified and sets forth the most probable configurations of other antenna components. The appendix gives brief descriptions of an antenna near Krasnovodsk and of the Mills cross at Serpukhov, both of which show specific component similarities to HEN ROOST.

SUMMARY

The HEN ROOST antenna system appears at two sites at the Sary Shagan Antimissile Test Center. The northern site consists of a 500-foot reflector screen, an elevated feed structure, and a clutter screen, in addition to microwave antennas, a control building, and support structures.

The reflector screen is fixed and heavily back-braced. It consists of a cut-section cylindrical paraboloid with the addition of (1) reinforcing at the top, or (2) a top-mounted rectangular plane screen, or (3) a more sharply curved section at the top (giving a double-curved screen). The angular curvature, and likewise the focal point, cannot be measured.

The tower-mounted feed has heavy horizontal bracing with a segmented curved feed reflector screen. The feed elements are not visible. Either the feed structure, or the feed reflector, or the combined structure and reflector may have declination motion. The feed reflector segments are either cut-section cylindrical paraboloids or double-curved.

The 620-foot-long clutter screen is positioned 300 feet in front of the reflector and extends beyond the northern end of the reflector.

The two HEN ROOST antennas are 3,500 feet apart, offset 550 feet, and have a major radiation orientation of [redacted]

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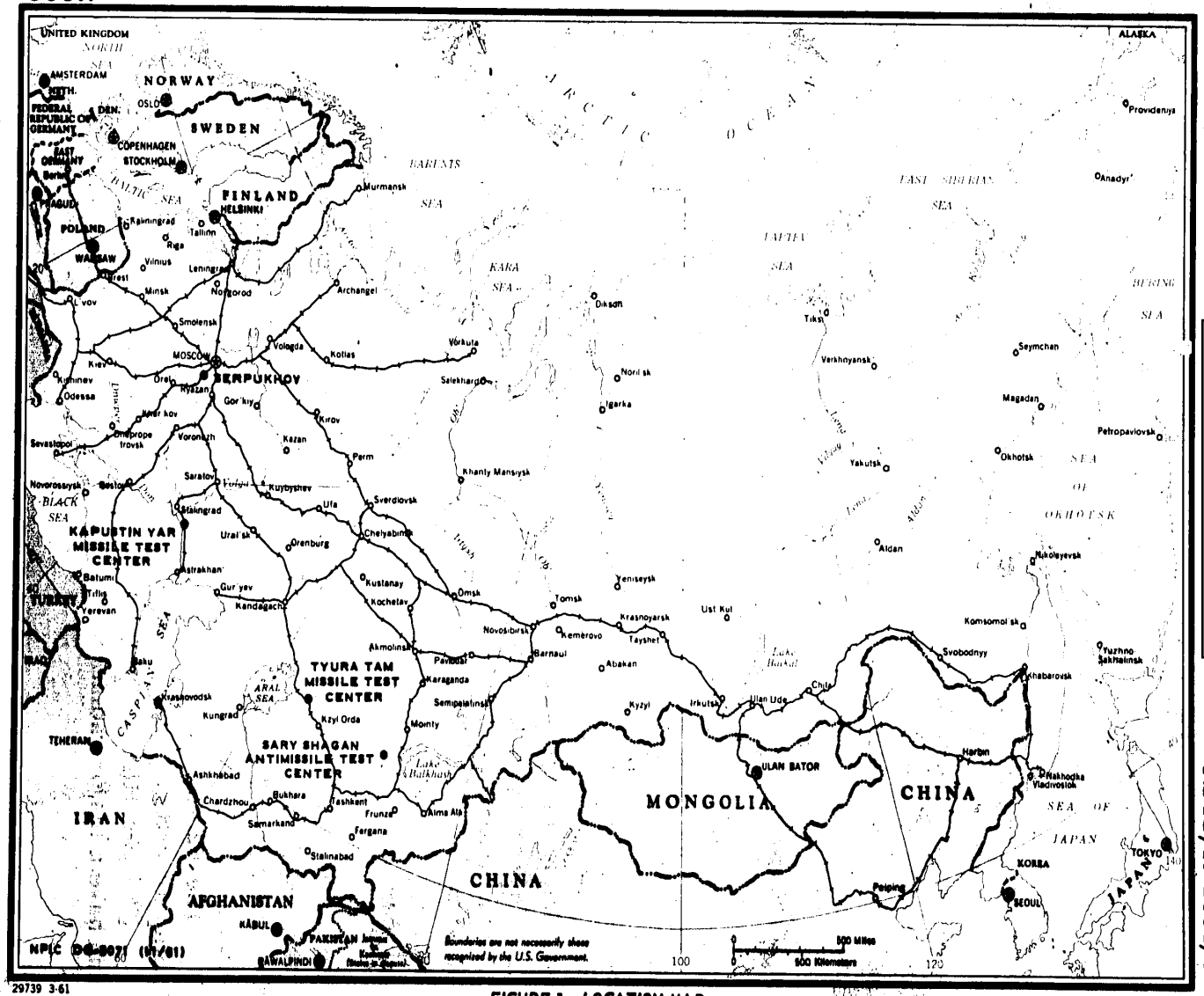

FIGURE 1. LOCATION MAP.

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INTRODUCTION

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The HEN ROOST antenna system at the Sary Shagan Antimissile Test Center (Figure 1) was analyzed from photography of [redacted] This analysis was hampered by more than 90 percent cloud cover over one site (the southernmost) and by partial cloud cover over the other site, in addition to unfavorable sun and photographic angles which necessitated deriving most antenna component configurations from ground shadows. This northernmost site, located at 45-56N 73-38E (Figure 2), is referred to as Radar Site 2 in CIA/PIC/JR-1010/61. 1/ However, further study of the photography indicates that the implication of the word "radar"

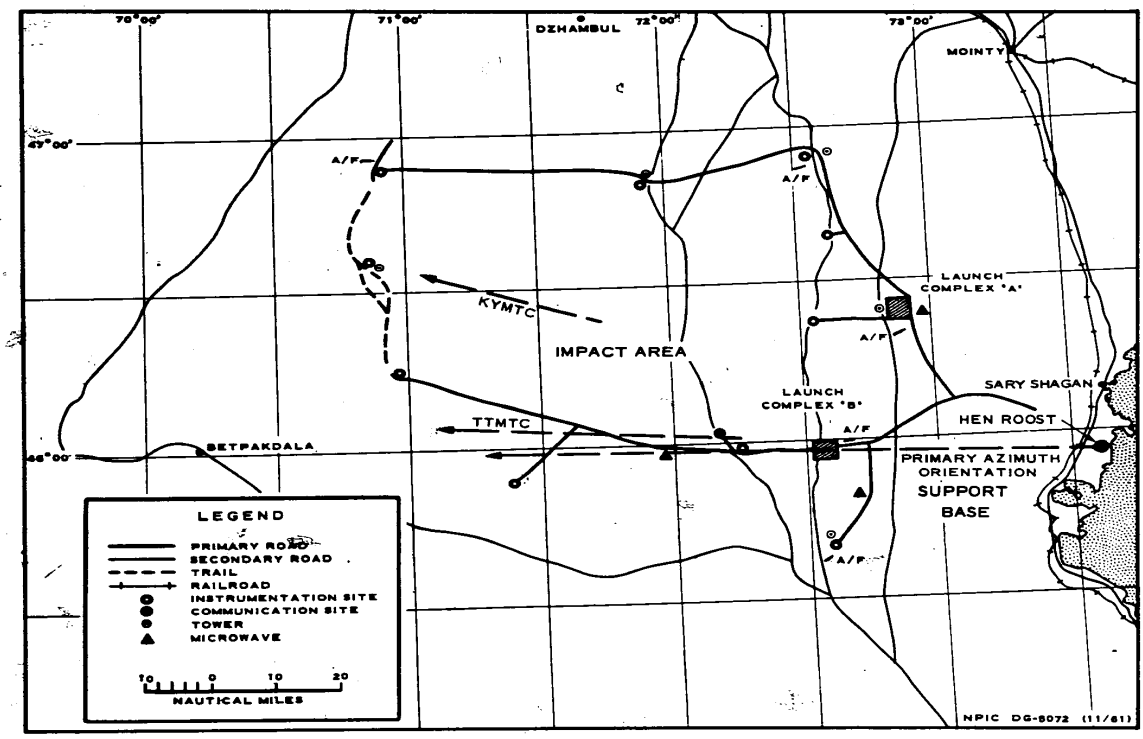

FIGURE 2. LOCATION OF HEN ROOST, SARY SHAGAN ANTIMISSILE TEST CENTER.

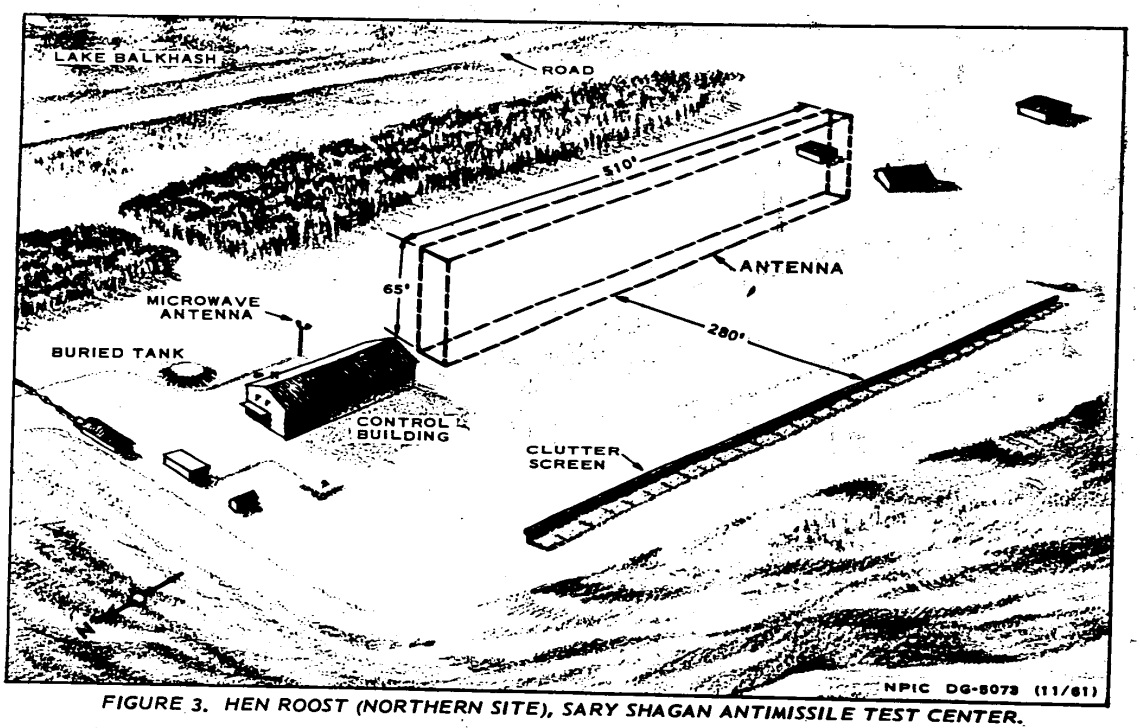

FIGURE 3. HEN ROOST (NORTHERN SITE), SARY SHAGAN ANTIMISSILE TEST CENTER.

is not specifically evident. Figure 3 is a perspective drawing of the site showing the location of operational and support facilities and the relationship between them. The site is served by an all-weather road from the Support Base, but no tie-in with the power grid can be identified. A water line leads from the site to Lake Balkhash. Adjacent to the antenna is a multistory building which may house computer equipment and is probably the main control facility at the site.

HEN ROOST ANTENNA ANALYSIS

The northern HEN ROOST site is the only one which could be studied in detail. Only a few antenna construction details are identifiable from the structure;

The definitive antenna components consist of a fixed reflector screen, an elevated feed structure, and a clutter screen. Reflector mesh size, focal point, angle of inclination, and feed-element configuration could not be determined from the photography. A rectangular ground pattern in front of the feed structure has an unknown function. The antenna appeared to be capable of operational status at the time of the photography.

Fixed Reflector Screen

The fixed reflector screen is basically a cut-section cylindrical paraboloid with its axis tangent to the earth's surface. Overall dimensions are 510 feet in length (horizontal) and 65 feet in chord (vertical), giving an area greater than 33,150 square feet (3,079.5 square meters). There are 13 main vertical ribs (including end ribs) following the curvature of the screen which appear to divide the reflector into 12 equal [redacted] meter) segments. Each vertical rib has a slanted back brace running to a large concrete footing. Each back brace appears to have secondary side braces affixed to the reflector.

A detailed study of the reflector shadow indicates that there is something along the entire top section of the reflector. This may be additional bracing from stiffening or else an alteration (not measurable) of screen curvature (Figure 4). If an alteration, it could be a rectangular plane screen

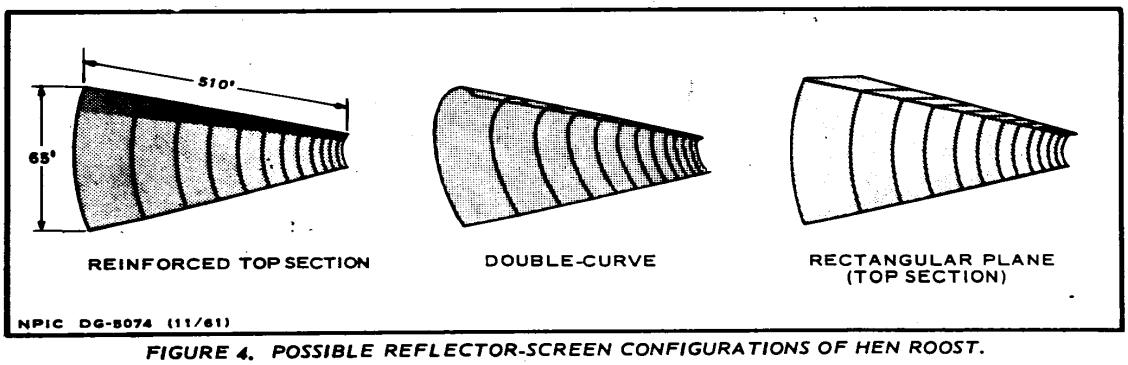

FIGURE 4. POSSIBLE REFLECTOR-SCREEN CONFIGURATIONS OF HEN ROOST.

or a sharply curved section (giving a double-curved reflector). The first alteration (rectangular plane screen) combined with the main reflector screen is similar in design to the antenna near Krasnovodsk (Figure 6).

Elevated Feed Structure

The elevated feed structure is in front of and parallel to the fixed reflector screen. The structure consists of a concrete base, 13 support towers, 2 end towers, 2 horizontal feed-element stabilization bars, and 12 segmented feed reflectors (Figure 5). These components have similarities to components of both the antenna near Krasnovodsk and the Mills cross near Serpukhov (see Appendix).

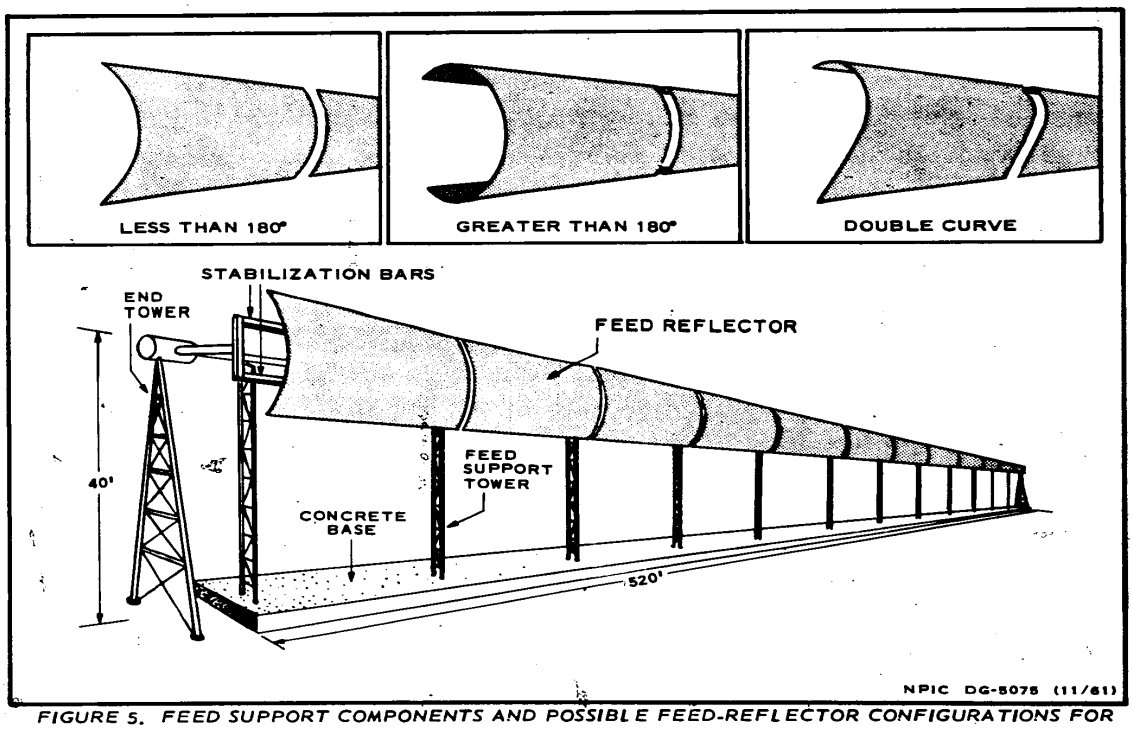

FIGURE 5. FEED SUPPORT COMPONENTS AND POSSIBLE FEED-REFLECTOR CONFIGURATIONS FOR HEN ROOST.

Concrete Base

The concrete base, measuring 520 by 35 feet and 5 feet high, is utilized as a footing for the 13 support towers. However, the height of this base, along with the fact that it extends between the support towers, appears to negate its utilization as only a footing. Beneath the support towers of the east-west leg of the Mills cross these are subterranean concrete chambers housing preamplifiers, transmission-line junctions, and phase-adjustment points. The concrete base for HEN ROOST may have a similar function, since no aboveground transmission/feed lines are visible.

Support Towers

The 13 support towers are bipods approximately 35 feet in height. The tower footings are transverse to the feed structure and have no apparent lateral support. The towers are equally spaced at [redacted] intervals -- the same spacing as for the vertical ribs in the reflector screen. The antenna support towers on the east-west arm of the Mills cross at Serpukhov (Figure 7) appear similar to the feed support towers at HEN ROOST. Support tower similarities at the two locations can be seen from the following data.

Antenna	No of Footings per tower	Tower Design	Tower Height (ft)	[redacted]	Static Loading
Mills cross	2	Heavy verticals, light horizontals, & crossed diagonals	65		Light
HEN ROOST	2	Same	35		Heavy

The feed support towers for the Mills cross antenna are designed for a light dynamic loading. Although no declination motion was observed for the HEN ROOST feed, the feed support towers have an inherent design capable of sustaining such a motion.

End Towers

The two end towers are bipods approximately 40 feet in height. They are on separate footings (not attached to the concrete base), and each
25X1D is [redacted] from the nearest feed support tower. The top of each end tower is on the same plane as the top of the feed support towers. Each end tower has a top-mounted unidentified cylindrical object whose central axis is aligned with the feed support towers. The end tower for the Mills cross antenna is a tripod, but otherwise is similar to the HEN ROOST end towers.

Horizontal Feed-Element Stabilization Bars

The two horizontal feed-element stabilization bars (upper and lower) are 510 feet in length, with an undetermined separation. These bars are plane parallel, with the upper bar being in a vertical or near vertical reference to the lower bar. The bars extend between the end towers and, from shadow analysis, appear massive. Between the end towers and the bars, an indistinguishable type of connecting link is visible. The basic structure formed by the bars appears similar to the feed structure for the antenna near Krasnovodsk.

Segmented Feed Reflectors

The 12 segmented feed reflectors appear to be basically cut-section cylindrical paraboloids, mounted on the forward side of the feed structure, and measuring approximately 40 feet in axial length. The axis of these reflectors is parallel to the feed structure. Three possible configurations for these reflectors, determined through shadow analysis, are: (1) an arc with an angle less than 180°, (2) an arc with an angle greater than 180°, and (3) a double-curved configuration (Figure 4). The mesh size cannot be determined.

Clutter Screen

25X1D The clutter screen (Figure 3) is parallel to and 280 feet in front of the concrete base of the feed structure. The screen is 620 feet long and [redacted] high and slopes away from the antenna. It runs the full length of the antenna and extends 110 feet beyond to the north. The ground appears to have been leveled for its construction. The clutter screen for the Krasnovodsk antenna is about the same length and distance out from the antenna.

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APPENDIX

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Antenna Near Krasnovodsk, USSR

This antenna, covered by [redacted] photography, is located at 40-02N 52-57E, 3 nm northwest of Krasnovodsk, USSR. The antenna, a large mattress type, is within a fenced area measuring 915 by 615 feet, situated on relatively high ground (Figure 6). The area also contains a feed mast, control building, and clutter screen.

25X1D The mattress antenna consists of an upended cut-section, half-cylindrical paraboloid and a plane section at one end at a 105° angle. The cut section measures [redacted] feet high and the plane section, 125 by 115 feet high. Both sections have equally spaced horizontal and vertical ribs.

The feed mast, measuring 30 by 110 feet high, is adjacent to the plane section at a point approximately 70 feet from the junction of the two sections. The feed mast may have a capability of rotation on its vertical

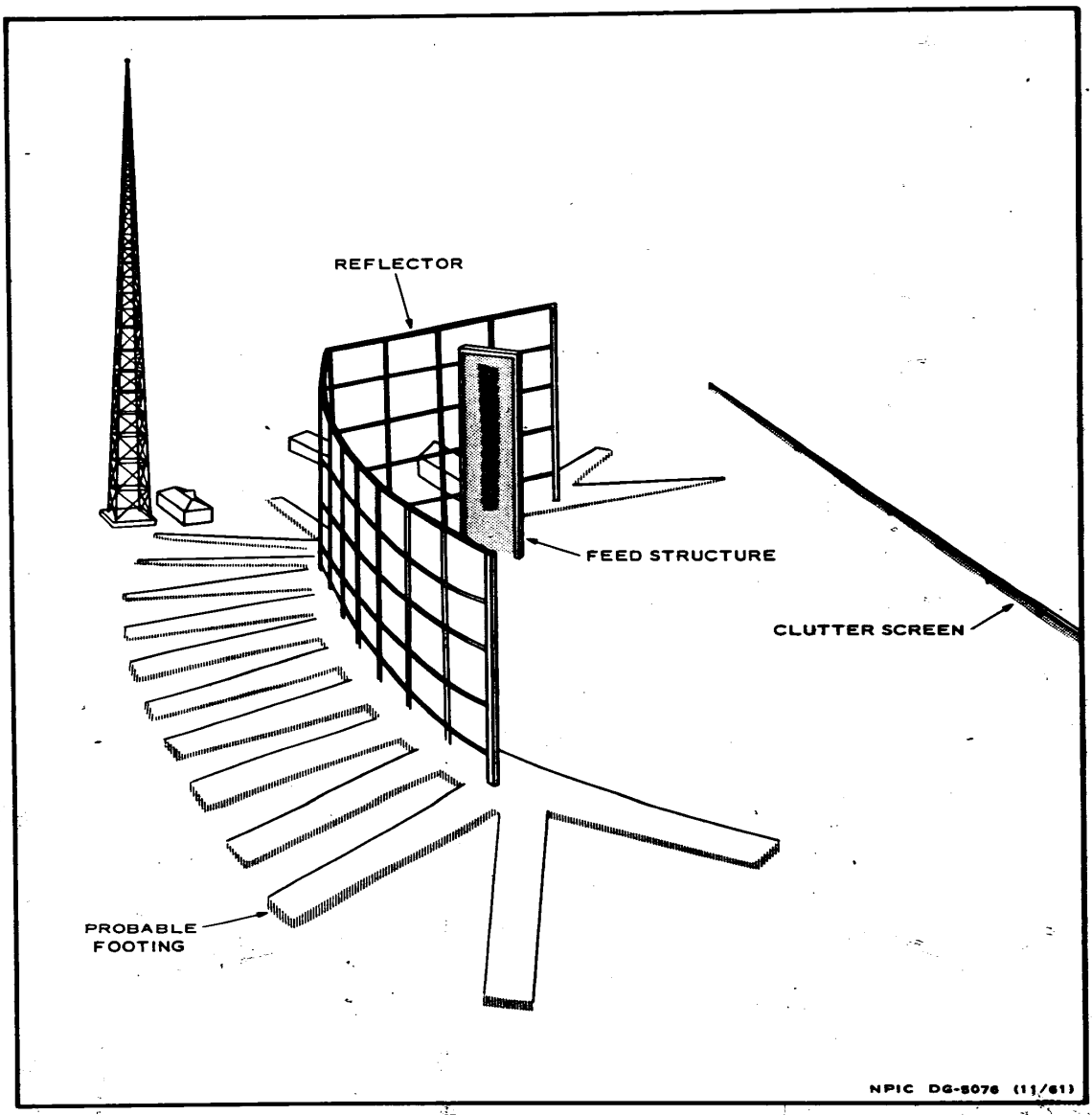

FIGURE 6. ANTENNA NEAR KRASNOVODSK, USSR.

axis. A cable line connects the feed mast to the control building. This building which is adjacent to the plane antenna section, measures 55 by 50 feet and is flat roofed. The clutter screen is 615 feet in length and 5 feet in height, and is on an azimuth of [redacted] along a line 300 feet in front of the mattress antenna. Long linear earth mounds, the purpose of which is unknown, lead off to the rear and sides of the reflector.

Mills Cross at Serpukhov, USSR
(Reprinted from Sky and Telescope, August 1961 2/)

The one-kilometer Mills cross ... at Serpukhov, USSR /Figure 7/ is an immense structure representing a very considerable investment. It is of rather straightforward design, having borrowed its principle from the original cross near Sydney, Australia, and its main structural features from the parabolic-cylindrical antennas constructed in the past several years by Martin Ryle and his colleagues at Cambridge University. Its great size, however, generates a host of new problems, some of which are being solved in ingenious ways and some by the application of sheer economic force.

FIGURE 7. MILLS CROSS, SERPUKHOV, USSR [redacted]

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